AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation November 1981

OUR NOVEMBER 2 MEETING will be for the purpose of discussing the results of the ARRL Amateur Radio Computer Networking Conference, just concluded. The meeting will be from 7:30 to 9 P.M., at the Patrick Henry Branch Library, Vienna, Virginia.

Nominations for AMRAD directors will also be accepted at the November 2 meeting. The terms of the following are expiring at the end of 1981:

Robert E. Bruninga, WB4APR	Director
Terry Fox, WB4JFI	Director
Paul L. Rinaldo, W4RI	Director
Richard Barth, W3HWN	Alternate
Elton Sanders, WB5MMB	Alternate

Continuing in office are:

Jeff Brennan, WB4WLW	Director
Bill Pala, WB4NFB	Director

Nominations may be made by any paid-up member either at the November 2 meeting or by mail if received by December 7. Mailing address is 1524 Springvale Avenue, McLean, VA 22101.

December 7 is the AMRAD annual meeting. That is the only "business" meeting that we have during the year. The main business is to elect 3 directors and 2 alternates. It also gives us a chance to reflect on what we did during 1981 and to discuss what we might do in 1982. One possible agenda item is packet repeaters for the Washington, DC area, both for local area use and the backbone network.

January 4 will feature a talk by George Lemaster on viewdata and TV captioning for the deaf. Please tell your deaf friends to come to this meeting. We will have a sign-language interpreter.

WE SKIPPED RENEWAL NOTICES on the last two issues because of the hurry to get the newsletters in the mail. If your copy is stamped this month, please renew your membership now before you forget all about it. If we sometimes stamp copies in error, please be aware that there is a delay between the several *volunteers* involved.

THE ARRL AMATEUR RADIO COMPUTER NETWORKING CONFERENCE was held on October 16 and 17 at the National Bureau of Standards and the NASA Goddard Space Flight Center. We think that it came off very well. It didn't leave much doubt that there are a number of dedicated and talented people around who are going to build a packet-radio network, ready or not.

Doug Lockart and Hank Magnuski are two key people for designing and promoting the network, as most of you know. Dave Borden and Paul Rinaldo spent as many hours with Doug and Hank as was possible during the conference. The main topic was network structure and protocols. Some worthwhile progress was made during these extra sessions, resulting in closer ideas on network architecture. On Sunday, October 18, this group was joined by Jens Zander, SM5HEV and Paul Galli,SM5DYW, who came from Sweden to attend the conference. They have done some impressive work at 100 kb/s using fsk on 430 MHz. We set up ssb skeds with them for the first Sunday in each month. One of the things that we talked about was the possibility of some Transatlantic packet tests on hf. *Is there anyone on the East Coast of the U.S. with a super hf ham station who would be interested in doing packet testing with stations in Europe?*

Printed proceedings are available for $5.00 per set of two volumes. Volume 1 can be mailed immediately. Volume 2 should go to press sometime in November. Checks should be made payable to "AMRAD" and mailed to 1524 Springvale Ave, McLean, VA 22101.

Audio tape recordings were made of all except the last session by Sandy, WB5MMB. He hasn't decided how to reproduce them yet. One option is to edit out the wasted time and copy them. Another is to transcribe on paper anything that differs from the printed proceedings. Sandy is extremely busy right now and would welcome some help.

Attendees want a conference next year, according to a straw poll. We're open for ideas as to where or when. At very least, we plan to have a packet radio gettogether at Dayton in 1982 and will try to get some time set aside on the Hamvention program.

PROTOCOL

David W. Borden, K8MMO
Rt 2, Box 233B
Sterling, VA 22170
703-450-5284 (Metro No.)

NEWS

The ARRL Amateur Radio Computer Networking Conference on October 16 and 17 was a great success and a step ahead for packet radio. The papers presented served as catalysts for discussions on protocol for the evolving Amateur Radio packet radio network. We met a number of interesting and helpful people.

Dennis Connors, KD2S gave an excellent paper on using the 6809 microprocessor chip in packet radio work. We had long talks with Den and found him to have a lot of good ideas. We shall be hearing of Phoenix area packet radio work soon, I am sure.

Steve Robinson, W2FPY provided a large amount of information concerning 220-MHz networking of repeaters. He has a repeater to useand is located high in Northern New Jersey. Den Connors provided linking information concerning New York state, and this line of repeaters could someday extend from Norfolk, VA to Montreal, Quebec.

Both Terry Fox, WB4JFI and I purchased ICOM IC-3AT 220-MHz rigs and are looking forward to packet work with Bill Moran, W4MIB who is already on 220. It is anticipated that the local area networks will probably be on 2 meters, but the smart station nodes will be on 220 MHz.

Work on the AMRAD single-frequency packet repeater (147.585 MHz) continues. Sandy, WB5MMB has some new requirements not originally in the specification. These ideas concern logging of the repeater by way of an audit trail to printer. Probably not much additional code is required (all programmers talk that way). The alternative suggested by Doug Lockhart, VE7APU at the conference was to have a logging node which kept track of things done on the frequency. That seems like a more elegant solution.

Some additional ideas surfaced concerning two-frequency packet repeaters. Hank Magnuski, KA6M thinks that digital regeneration may be superior to store and forward for packet repeating. How to do this regeneration is not clear. Doug Lockhart suggests that hooking two Bell standard 202 modems back to back does not work well because jitter is introduced. Hooking two packet boards back to back is very expensive. Some compromise, similar to the old RTTY regenerative repeaters seems in order. Two frequencies are preferred due to the hidden transmitter problem (all users cannot hear all other users in a single-frequency situation).

I received a copy of the new Terminal Interface Program (TIP) code at the conference. I will be publishing a new set of four ROMs to current users directly. The data-transparent frame is required for future networking. This implements control functions by preceeding them with up arrows. This presents a small problem on some terminals as there is no way to send up arrows on various popular keyboards. A solution will be found soon because Hank Magnuski owns one of these offending terminals. I do also, so another delimiter will be chosen.

A problem has arisen on terminology. What should you call the smart station node which links local areas into the network? Station node is probably a term to be reserved for Doug Lockhart's smart node which handles local areas and networking. Suggestions are in order here. The computer that gets the local area into the backbone network is what next year is all about. The ARPANET Internet Protocol will probably be adopted in some form by network users. Copies of this protocol will soon be available from my computer on the local area Metro node. I received a copy of it from Hank on disk. It takes a long time to print so call up my computer in packet and remove a copy for yourself.

I am not really in the snake oil business, but I have VADCG TNC boards and chip sets. A board is $30, and a chip set (8273 and 8250) is $46.50. Pickup is encouraged, or include some postage cost. I just keep these around for local guys to get going quickly. The board and chip set only require several trips to a Jim-pak store to complete. Radio Shack can help you complete a board, also, at some additional cost. Thanks to all who made the conference a success.

Protocol for the W9JD FEC ARQ System

Jerome T. Dijak, W9JD
215 Tareyton Drive
Ithaca, NY 14850
607-257-3909

BLOCK FORMAT

Each encoded block in this system consists of 15 8-bit bytes. The first byte is a 55H start flag. It is used by the receiving software to detect the start of a block, and also by the decoder to detect when a block has been corrected to a cyclically shifted version of the original block. The second byte is the block address field which identifies idle frames, acknowledge blocks, and sequential data blocks.

The third through ninth bytes are the "data" for this block. The last six bytes of the block are the check symbols uniquely computed by the encoder module for the given first nine bytes of the block.

INTER-BLOCK GAP

Decoding is accomplished immediately after receiving a complete block. To allow time for this, one or more fill characters are sent between blocks. These fill characters are ASCII nulls (00H) since this character is the best for regaining character synchronization once the decoding process has been completed and the receiving system is ready to detect another block.

Any number of null characters may be sent between blocks, but the larger the number the lower the system throughput. The minimum number appears to be one, and the maximimum useful number for these is probably about four -- with this long gap being advantageous only when a very loose correlation constant is in use with the detection software that looks for the block start flag. One or two inter-block characters seems to be the optimum number.

Also during the inter-block period are sent the link commands, which are single bytes which indicate changes in the link status to the distant end computer. Currently, there are three types of control commands, although more may be added later:
a) EOT (end of transmission - 24H),
b) BCST (go to broadcast mode - 44H), and
c) ARQ (go to ARQ mode - 22H).

Link control bytes are sent repeatedly during the inter-block period, a variable number of times (10 to 30), and the receiving system must recognize two consecutive control bytes before the prescribed action is taken. This is to insure that link control changes are not caused spuriously by noise or interference in the channel.

BLOCK ADDRESS POLICY

Data Blocks. Valid addresses for data blocks are 00 through 0FCH. The transmitting station generates blocks with sequential addresses, and the sequence "wraps around" to 00 after block 0FCH has been sent. To make them simple to trap out at the receiving end, the special control frames use special block addresses.

Idle Frames. Whenever the system has no data to send, it will send idle frames. These are blocks with 0FDH addresses which merely keep the sending and receiving systems active, and keep the channel occupied. They are trapped out without being displayed or processed by the receiving computer.

Acknowledge Blocks. Correctly received data blocks are acknowledged back to the sending station by loading their addresses into a special block, called an ACK Block, which is then assigned a special 0FFH address, encoded, and sent. Each of these blocks is processed specially at the sending station, and those blocks that were acknowledged are no longer transmitted. Blocks that have been sent but not acknowledged by the receiving station are continually retransmitted until acknowledged.

Block address 0FEH is currently not used, but is reserved for possible future use.

LINK MODES

The system operates in one of two link modes, Broadcast (BCST) or Automatic Repeat Request (ARQ) at any given time. The system initially starts up in BCST mode.

BCST Mode. In BCST mode, the system operates much like a convential RTTY system, except that the data is "blocked" and encoded prior to transmission. The receiving station decodes and displays the data as it is received, but now that it is encoded, many of the channel errors can be corrected before the data is displayed.

In BCST mode, the computers are not automatically acknowledging and retransmitting blocks. BCST mode is used for two purposes: 1) to establish contact with another station prior to entering ARQ mode simultaneously, and 2) in a multiple-station QSO (a net) where the ARQ process cannot be accommodated due to the multiple receiving stations.

ARQ Mode. Once contact has been established with another station in BCST mode, the link may be transitioned to ARQ mode by

a keyboard control command at the station who is transmitting at the time. A special control byte is then sent over the link to force both station computers into ARQ mode simultaneously. Once in ARQ, the system automatically switches the radios at each station from transmit to receive periodically.

In ARQ mode, only fully correct blocks are displayed, correctly received blocks are each automatically acknowledged back to the sending station, and garbled blocks are automatically retransmitted.

BLOCK SENDING POLICY

In BCST mode, blocks are sent as soon as 7 data characters are ready. When no data is ready, idle frames are transmitted to keep the channel active.

In ARQ mode, data blocks currently in the encoding buffer are continually retransmitted when there is no further new data to send. (This takes the place of the idle frames in BCST mode.) All ACK blocks generated during a previous receive interval are sent at the beginning and end of each transmit interval, while in ARQ mode.

INITIAL CONTACT PROCEDURES

Initial contact between stations is established in BCST mode. When both stations are ready to enter ARQ mode, the transmitting station (at that time) enters the keyboard control command to put both stations into ARQ mode.

Auto LF. No line feeds are transmitted at the end of lines. The receiving software automatically generates an LF on encountering a carriage return. Deliberate line feeds, such as for text spacing, are handled normally.

Cw I-d. The system keeps track of how many blocks have been transmitted since the last cw identification was broadcast. After a preset number of blocks, which should represent 3 to 5 minutes of transmit time, a cw i-d is automatically sent between blocks. This does not disrupt the data transfer process except for the short delay incurred. □

THE FCC HAS AUTHORIZED AN EXPERIMENTAL BEACON on the bands 10.1-10.15, 18.068-18.168 and 24.89-24.99 MHz, these bands being the ones allocated for Amateur Radio use by WARC 79. The experiment is intended to permit amateurs to become familiar with the characteristics of these bands, simplifying the scheduled change-over to amateur use. An important element is securing data on propagation under weak signal conditions.

The experiments will include two emission types, three operating modes and two time phases. Basic emission is unmodulated carrier (AØ), interrupted each ten minutes for an SSB (2.8A3J) identification and announcement, this occurring at 2, 12, 22... minutes past the hour. The station will use the call sign KK2XJM.

Initial operations will be at 3 watts ERP on 10 MHz commencing about October 1. Depending on results, the schedule will include 18 and 25 MHz and operation at 30 watts ERP.

Information needed by KK2XJM is date, time and location of reception, strength of signal and of other signals on the band, and nature of the receiving installation. All reports will be ackknowledged by QSL card. In addition to reception reports, proposals for special tests will be welcomed, subject to the limitations imposed by the license. At this time there is no authorization for communication with amateur stations. Reports, requests for schedules and proposals for experiments may be sent to R. P. Haviland, W4MB, 2100 S. Nova Rd, Box 45, Daytona Beach, FL 32019.

CORRESPONDENCE:

Dear Paul,

...HAMNET is one of the Special Interest Groups on CompuServe. There is no additional charge for the HAMNET BBS, other than normal connect charges. A meeting place for amateurs and those who are interested in amateur radio, we currently have about 240 members across the country. Functioning much like a normal telephone connected Bulletin Board System, HAMNET allows the posting and retrieval of messages, both public and private, Interest sections for AMSAT, RTTY/PACKET PEOPLE, TRAFFIC, SWAP/SHOP, etc. Until nationwide packet hookups are operational, HAMNET offers the amateur radio computerists a nationwide forum without those expensive long-distance charges.

Access to HAMNET from Micronet is gained by the Command " R SIGS(HAMNET)".

73's
Wayne Day, WA5WDB
1779 Continental Drive
Blue Mound, TX 76131

THE WORLD ADMINISTRATIVE RADIO CONFERENCE, Geneva, 1979, adopted Recommendation No. 65 (ZM), recognizing that advances in technology, particularly digital radio techniques and new encoding, modulation, and access schemes are making practicable new sharing schemes that offer technological advanced for increasing the efficiency of spectrum sharing. On June 22, 1981, the U.S. issued a draft report on packet radio technology in response to Question AR/9. The report describes current experiments in the 1710-1850 MHz band using M140F9 emission, direct spread spectrum modulation with minimum-shift keying (MSK) at a chip rate of 92.5 MHz, information rate of 90 kb/s or 360 kb/s, with a processing gain of 30 dB and a power output of 10 dBW. *Thanks Chuck Dorian.*

THE DEAF AND THE TTY

Barry Strassler
Executive Director
Telecommunications for the Deaf, Inc.
814 Thayer Avenue
Silver Spring, Maryland 20910
301-589-3006

ELECTRONIC MAIL IN PERSPECTIVE

It has been over three years since the first electronic mail system for the deaf has come out. The first one was the HERMES system of the Deaf Community Center; Framingham, MA. Then came DEAFNET in the Washington, DC and San Francisco Bay areas. HERMES expired due to lack of funding, but in its place is the GTE Telemail system. In between was the Virginia TTY message system, originated by Bob Bruninga.

The TDI board of directors, now on the GTE Telemail system, has become the first national deaf organization to use electronic mail as a main means of communications. Still, five ASCII terminals had to be lent to the directors that did not have them.

One former Congressional aide on the House Subcommittee on Telecommunications blasted DEAFNET as a technological success but a human factor failure. His words carry merit and weight but there are mitigating factors. You can bring a horse to water, but you can't make the horse drink, so goes the cliche. Perhaps this is true in telecommunications.

When people, not necessarily deaf, are so new to computers, or vice versa, they are overwhelmed by instructions and a range of commands that must be executed to get the "thing" working properly. It is like a tyro expected to pilot a 747 when all of his training has been on Pipers and Cessnas.

Training is one aspect of the picture. If a set of instructions are thrown in with a new terminal, it would be folly to expect the average user to master the intracacies right off the bat. They need person-to-person training, and many times it is just unavailable. Operating difficulties turn them off, and this new technological innovation is wasted on them.

The second aspect is the availability of equipment on hand. DEAFNET and HERMES (now Telemail) were studies in contrast. DEAFNET was compatible with ASCII and Baudot terminals. On the other hand, HERMES required ASCII terminals, as did Telemail. DEAFNET supposedly was more accessible to the average user, but it was local in nature. A Chicago person had to call long distance in order to log onto DEAFNET. Telemail is nationwide, but use was restricted to those having ASCII terminals. Those without these terminals would have to beg, borrow or steal them in order to log on.

Perhaps in due time, electronic mail systems will be as commonplace as telephones and television sets in American homes. □

THE GEORGE WASHINGTON UNIVERSITY Continuing Engineering Education, School of Engineering and Applied Science, Washington, DC 20052, telephone 202-676-6106 or 800-424-9773, is offering the following courses of possible interest to our members:

Feb	1- 5	Fiber and Integrated Optics
Feb	1- 5	Digital Transmission Systems Engineering, Orlando, FL
Feb	4- 5	Public and Private Packet Switched Networks, Orlando, FL
Feb	8-11	Synchronization in Spread Spectrum Systems
Feb	8-12	Digital Signal Processing

Unless otherwise indicated, courses are held in Washington, DC.

A TEKTRONIX 511AD 'SCOPE w/manual in good condition is available from Guy Black, W4PSJ, 12317 Hanger Rd, Fairfax, VA 22033, 703-691-0625, for $50.

BUZZ GORSKY, K8BG is interested in getting in touch with someone who might be willing to run some ASCII/packet tests with him on hf or vhf. At this point, he's using his TRS-80 for RTTY and wants to make the transition to packets. His address is 712 Hillside Dr, Carlisle, PA 17013. *Ed Note: Suggest you & another local ham build up VADCG TNC boards. One of those mountains near York, PA might have a shot into the planned AMRAD packet rpt.*

Before the
Federal Communications Commission
Washington, D. C. 20554

FCC 81-290
29504

In the Matter of)
)
Amendment of Parts 2 and 97 of the)
Commission's Rules and Regulations to) GEN DOCKET NO. 81-414
authorize spread spectrum techniques)
in the Amateur Radio Service.)

NOTICE OF INQUIRY AND PROPOSED RULE MAKING

Adopted: June 30, 1981 Released: September 18, 1981

By the Commission: Commissioner Washburn concurring and issuing a statement; Commissioners Fogarty and Jones absent.

Introduction

1. The Federal Communications Commission is initiating this proceeding to propose changes in its Rules and Regulations to permit the use of spread spectrum modulation in the Amateur Radio Service. Although this modulation technique is not explicitly prohibited in the Amateur Service, its wideband spectral characteristics result in it being implicity forbidden by the rules. The Commission feels that spread spectrum modulation is technically compatible with the present modes of operation in the Amateur Service. Allowing amateur experimentation with this relatively new modulation technique is therefore in harmony with the basis and purpose of the Amateur Radio Service. 1/ Therefore, the Commission is proposing to amend Parts 2 and 97 of its Rules and Regulations to authorize the use of spread spectrum modulation techniques.

1/ Section 97.1(b) of the FCC Rules and Regulations illustrates in part the basis and purpose of the Amateur Radio Service as the "continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art."

2. Although we feel comfortable proposing the authorization of spread spectrum modulation in the amateur service at this time, we recognize that its use may confront the Commission with a number of problems. In spread spectrum systems a coding process is generally used to spread the signal's energy across a wide band of frequencies. It is necessary to know the code sequence in order to demodulate the signal and recover its content. Wideband receivers may be required to make technical measurements on the transmitted signal. There is a potential for interference in overlaying wideband emissions on amateur bands already occupied with conventional narrow band signals, although this is limited due to the low power density of spread spectrum signals. For these reasons, this Notice also requests comments on problems associated with the enforcement and interference issues raised by authorizing spread spectrum modulation in the Amateur Radio Service.

Background

3. Spread spectrum techniques were originally developed for military applications concerning covert communications and/or resistance to jamming. The radio frequency (RF) signal transmitted in a spread spectrum system occupies a very large bandwidth, perhaps many megahertz, as compared to the information signal's bandwidth. This wide bandwidth provides for the military a signal that is very hard to detect or jam. Spread spectrum emissions possess qualities, however, that may also be desirable to civil users of the spectrum. 2/

4. All spread spectrum systems employ some function other than the information signal to spread the RF bandwidth. 3/ Direct sequence modulated and frequency hopping systems both use a high speed pseudorandom code sequence to achieve a large RF bandwidth. In direct sequence systems, this code sequence is combined with the information signal and this composite signal is used to modulate an RF carrier. The code sequence is used in frequency hopping systems to control a frequency synthesizer which generates the transmitter's many carrier frequencies. In pulsed-FM systems, a voltage function is used to sweep the transmitter's carrier over a wide frequency range. Although somewhat different in design, all three of these systems result in an RF signal with a very wide bandwidth. More detailed descriptions of the operation of these systems may be found in an IEEE press publication entitled Spread Spectrum Techniques. 4/

2/ See, for example, the following FCC funded report: Walter C. Scales, "Potential Use of Spread Spectrum Techniques in Non-Government Applications", the MITRE Corporation, Report No. MTR-80W335, December 1980. This report is available from the National Technical Information Service, Springfield, VA 22161, Accession No. PB81-165284.

3/ R.C. Dixon, Spread Spectrum Systems, New York, Wiley-Interscience, 1976, p. 3.

4/ Spread Spectrum Techniques, ed. Robert C. Dixon, New York, IEEE Press, 1976.

5. The Commission recognizes that spread spectrum may offer the communications user some unique advantages. Today the Commission adopted a Notice of Inquiry in the matter of wideband modulation techniques, including spread spectrum. 5/ The Inquiry explores some possible civil uses of spread spectrum modulation and indicates some of the advantages associated with it. The coding techniques used in spread spectrum systems, for example, allow message privacy, selective addressing and code division multiple access. These last two advantages provide the user the ability to selectively access only one or a fraction of the total number of receivers sharing the same spectrum. Spreading the signal at the transmitter and collapsing it at the receiver result in a low signal power density while simultaneously providing the ability of the system to reject interference. These features suggest the feasibility of overlaying spread spectrum systems on occupied spectrum. While the Commission is investigating the general question of spread spectrum desirability under that Inquiry, it may be that spread spectrum can be introduced into the Amateur Service with minimum potential for interference.

6. Spread spectrum techniques have not gone unnoticed in the amateur community. An article published in QST, the official publication of the American Radio Relay League, cited spread spectrum as a technology ripe for amateur experimentation. 6/ The article indicated that the Amateur Radio Research and Development Corporation (AMRAD) would soon petition the Commission for Special Temporary Authorization (STA) to conduct tests using spread spectrum modulation. In March of this year the Private Radio Bureau, acting under delegated authority from the Commission, granted AMRAD an STA allowing the specific tests outlined in their petition. 7/ Upon expiration of the STA, AMRAD must submit its findings to the Commission. The reports required by the STA will be inserted in the record of this proceeding and will be considered before final action is taken. If the results of the STA and the aforementioned NOI are favorable, the Commission will consider expanding the authorization of spread spectrum techniques. Now, however, the Commission proposes rule changes to permit broader experimentation with spread spectrum techniques in three bands.

Discussion and Proposal

7. Spread spectrum systems are inherently more complex than narrowband systems. Amateurs wishing to experiment with spread spectrum techniques will almost certainly have to construct their own equipment, due to the lack of commercially available equipment. The principle technical problem will be constructing devices which maintain their parameters over wide

5/ Notice of Inquiry, General Docket 81-413 ,adopted June 30, 1981, FCC 81-289.

6/ Paul L. Rinaldo, "Spread Spectrum and the Radio Amateur", QST, November 1980, pp. 15-17.

7/ The STA was issued on March 6, 1981 for a period of one year. Although it permits spread spectrum modulation, only those techniques necessary to perform the indicated experiments were authorized. Also, the authorization is limited to those amateurs that were included in AMRAD's petition.

bandwidths. Incorrectly or poorly designed equipment will increase the possibility of both intra-service and inter-service interference. It is for this reason the Commission feels that authorization to use spread spectrum techniques should be restricted to Amateur Extra and Advanced Class licensees only. Amateurs presently licensed in these two classes have been tested in the advanced phases of radio electronics; material covering spread spectrum techniques will be added in the future to the appropriate examination syllabuses.

8. The Commission proposes to authorize spread spectrum modulation in the following three frequency bands: 50-54 MHz, 144-148 MHz, and 220-225 MHz. The International Telecommunications Union (ITU) Regulations require that "transmissions between amateur stations of different countries...shall be made in plain language." 8/ Since this might restrict the international transmission of spread spectrum signals, we propose frequency bands above 50 MHz so as to naturally limit propagation. Most of the frequency bands allocated to the Amateur Service above 225 MHz are shared with government users. 9/ Amateurs operating in these bands must not interfere with government systems. Rather than coordinate spread spectrum systems with government users in these bands at this time, the Commission proposes restricting spread spectrum transmissions to frequencies below 225 MHz. 10/ However, we welcome requests for STA's to perform limited spread spectrum experiments in the amateur bands above 225 MHz and will consider these on a case by case basis.

9. The Table of Frequency Allocations prohibits the use of pulsed emissions in a number of frequency bands including 50-54 MHz and 144-148 MHz. 11/ It appears that this prohibition is no longer necessary, so we propose to discontinue it by deleting footnote US 1. Because WARC '79 adopted new emission designators, the use of which will be addressed in another proceeding, we will not at this time assign a designator to spread spectrum modulation. Until the Commission implements the decisions of WARC '79, we will use a footnote in the rules to indicate the authorization of spread spectrum modulation in a particular frequency band.

8/ Article 41, Section 2(1), Radio Regulations Annexed to the International Telecommunication Convention (Geneva, 1959). (See FCC Rules and Regulations, Part 97, Appendix 2).

9/ FCC Rules and Regulations, Part 97, Section 97.61 (b)(5).

10/ The 220 to 225 MHz band is also shared with government users. However, the Interdepartment Radio Advisory Committee (IRAC) has already indicated that they would not object to amateur use of spread spectrum modulation in this band. Goverment radiolocation systems will still be the primary users in this band.

11/ FCC Rules and Regulations, Part 2, Section 2.106, footnote US 1.

10. In order to allow amateurs maximum flexibility in the design of spread spectrum systems, the Commission intends to permit direct sequence modulated, frequency hopping, pulsed-FM, and hybrid systems. 12/ We propose only that a system's authorized RF bandwidth be equal to or less than the width of the amateur band that the system is operating in and retained within that band. Therefore, amateurs may spread their transmitted energy across the complete band they are using. Although we do not anticipate interference problems, considering our limited operational experience with spread spectrum transmissions we are proposing that the local Engineer in Charge be allowed to require stations transmitting spread spectrum signals to take whatever steps are necessary to resolve cases of interference, including terminating operation. We request comments on our belief that the interference potential in overlaying spread spectrum on the three bands proposed here is low.

11. Amateurs are presently forbidden to transmit coded messages in either domestic or international communications. 13/ Because of the previously cited ITU regulation, international transmission of spread spectrum signals will not be allowed. However, we shall exempt spread spectrum transmissions between domestic stations from this prohibition.

12. In order to facilitate the demodulation of spread spectrum emissions, we propose to require that any pseudorandom sequence used in generating the spread spectrum signal must be the output of one of a number of specific linear feedback shift registers. 14/ We propose specific shift registers in the appendix because they provide the minimum level of coding necessary to spread the signal. We realize that more sophisticated coding procedures could be employed, but their use would further obscure the meaning of the communications. This would appear to violate the intent of Section 97.117 of the present rules. Additionally, we will require that amateurs log the technical characteristics of their transmitted signal and that identification be given in telegraphy on the center frequency of their signal.

13. A major concern of the Commission in allowing amateur use of spread spectrum techniques is the Commission's, and the amateur's own, ability to monitor and locate stations transmitting wideband emissions. Presently the Field Operations Bureau (FOB) monitors the content of amateur transmissions to insure that amateurs are not transmitting communications which are prohibited by our rules. 15/ This monitoring, coupled with the self policing afforded by the amateurs themselves, assures the bands remain useable for amateurs and are not usurped by business or clandestine activities. However, FOB currently has no capability to monitor spread spectrum emissions. We propose to amend

12/ Hybrid spread spectrum systems are created by combining two or more of the basic spread spectrum techniques, e.g. a frequency hopping, direct sequence modulated system.

13/ FCC Rules and Regulations, Part 97, Section 97.117.

14/ For more information on linear code generator configurations, see R.C. Dixon's discussion in Spread Spectrum Systems, New York, Wiley-Interscience, 1976, pp. 60-64.

15/ See FCC Rules and Regulations, Part 97, Subpart E - Prohibited Practices and Administrative Sanctions.

Section 97.117 to include provisions to facilitate monitoring both by FOB and by other amateurs. We have precluded the use of esoteric encryption schemes and instead required that spreading codes be generated by linear shift registers. This will result in signals which may be received with only reasonable effort. This should facilitate self-monitoring, which has historically been very effective in the Amateur Radio Service. Additionally, we have proposed that amateurs log the technical characteristics of their signals and identify their transmissions in telegraphy. Considering that the characteristics of spread spectrum, e.g. low power density, are such that its transmission will not be disruptive to other users and the experimental nature of the Amateur Radio Service, we feel that we have imposed sufficient safeguards against its misuse. However, we request comments on these and other conditions the Commission could require to mitigate enforcement problems.

Questions

14. The questions listed below are not exhaustive. They merely typify the Commission's areas of concern. Information not directly responsive to these questions but relevant to the general subject matter of the Inquiry is welcome and invited. To facilitate staff review each response should clearly state the precise topic or question being addressed.

15. Please provide answers and supporting data to the following questions:

(a) Are the emission limitations specified in the proposed amendment to Section 97.73 of the rules sufficient to prevent interference from spread spectrum systems to users in adjacent bands?

(b) Will interference to conventional amateur communications be a major problem? If so, what steps can the Commission take to mitigate this problem? What types of other communications will be most vulnerable?

(c) Is it necessary for the Commission to have the capability to monitor the content of all amateur communications? If not, how can we enforce the limitations on the use of the amateur service and detect unlicensed transmissions?

(d) Will the specific shift registers proposed in the amendment to Section 97.117 of the rules facilitate self-monitoring by the amateur community?

Procedural Matters

16. Accordingly, the Commission adopts this Notice of Inquiry and Proposed Rule Making (NOI/NPRM) under the authority contained in Sections 4 (i) and 303 of the Communications Act of 1934, as amended. The proposed amendments to Part 2 and Part 97 of the rules are set forth in the appendix.

17. Pursuant to Section 605 (b) of the Regulatory Flexibility Act, the Commission finds that this NOI/NPRM will have no effect on small businesses. The frequencies involved are assigned to the Amateur Radio Service, which by definition is used for non-business communications only. To the extent that organizations such as amateur radio clubs hold amateur licenses, the only effect of the proposed action will be to enable these clubs to experiment with spread spectrum techniques, presumably for wider dissemination to the amateur community.

18. For purposes of this non-restricted notice and comment rule making proceeding, members of the public are advised that ex parte contacts are permitted from the time the Commission adopts a notice of proposed rule making until the time a public notice is issued stating that a substantive disposition of the matter is to be considered at a forthcoming meeting or until a final order disposing of the matter is adopted by the Commission, whichever is earlier. In general, an ex parte presentation is any written or oral communication (other than formal written comments/pleadings and formal oral arguments) between a person outside the Commission and a Commissioner or a member of the Commission's staff which addresses the merits of the proceeding. Any person who submits a written ex parte presentation must serve a copy of that presentation on the Commission's Secretary for inclusion in the public file. Any person who makes an oral ex parte presentation addressing matters not fully covered in any previously-filed written comments for the proceeding must prepare a written summary of that presentation; on the day of oral presentation, that written summary must be served on the Commission's Secretary for inclusion in the public file, with a copy to the Commission official receiving the oral presentation. Each ex parte presentation described above must state on its face that the Secretary has been served, and must also state by docket number the proceeding to which it relates. See generally, Section 1.1231 of the Commission's Rules, 47 C.F.R. §1.1231. A summary of Commission procedures governing ex parte presentations in informal rule making is available from the Consumer Assistance and Information Division, FCC, Washington, D.C. 20554.

19. Pursuant to the procedures set forth in Section 1.415 of the Commission's Rules, interested persons may file comments on or before March 1, 1982 and reply comments on or before April 15, 1982. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information or a writing indicating the nature and source of such information is placed in the public file, and provided that the fact of the Commission's reliance on such information is noted in the Report and Order.

20. In accordance with the provisions of Section 1.419 of the Commission's Rules, formal participants shall file an original and five copies of their comments and other materials. Participants wishing each Commissioner to have a copy of their comments should file an original and 11 copies. Members of the general public who wish to express their interest by participating informally may do so by submitting one copy. All comments are given the same consideration, regardless of the number of copies submitted. All comments should be clearly marked General Docket No. 81-414 , and will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, D.C. All written comments should be sent to : Secretary, Federal Communications Commission, Washington, D.C. 20554. For further information on this proceeding, contact Michael Kennedy at (202) 632-7073. For general information on how to file comments, please contact the FCC Consumer Assistance and Information Division at (202) 632-7000.

Federal Communications Commission

William J. Tricarico
Secretary

APPENDIX

Part 2 of the Commission's Rules and Regulations is proposed to be amended as follows:

In section 2.106, remove footnote US 1 and all references to it in the Table of Frequency Allocations.

Part 97 of the Commission's Rules and Regulations is proposed to be amended as follows:

In § 97.3, Definitions, add a new paragraph (aa) to read as follows:

* * * * *

(aa) Spread spectrum techniques. Any of a number of modulation schemes in which, (1) the transmitted radio frequency bandwidth is much greater than the bandwidth or rate of the information being sent and, (2) some function other than the information being sent is employed to determine the resulting modulated radio frequency bandwidth.

In § 97.7, Privileges of operator licenses, revise paragraphs (a) and (d) to read as follows:

(a) Amateur Extra and Advanced Class. All authorized amateur privileges including exclusive use of spread spectrum techniques and exclusive frequency operating authority in accordance with the following table:

* * * * *

(d) Technician Class. All authorized amateur privileges, except spread spectrum techniques, on the frequencies 50.0 MHz and above. Technician Class licenses also convey the full privileges of Novice Class licenses.

* * * * *

In § 97.84, Station identification, add a new paragraph (h) to read as follows:

* * * * *

(h) When an amateur radio station is modulated using spread spectrum techniques, identification in telegraphy shall be given on the center frequency of the transmission. Additionally, this identification shall include a statement indicating that the station is transmitting a spread spectrum signal and the upper and lower frequency limits of that signal.

In § 97.103, Station log requirements, revise existing paragraph (g) and redesignate it as paragraph (h), and add a new paragraph (g) to read as follows:

* * * * *

(g) In addition to the other information required by this section, the log of a station modulated with spread spectrum techniques shall contain information sufficiently detailed for another party to demodulate the signal. This information shall include at least the following:

(1) A technical description of the transmitted signal. If the signal is modeled after a published article, a copy of the article will be adequate.

(2) The dates that the signal format is changed. Changing the center frequency of the signal does not constitute a change in signal format.

(3) The chip rate (rate of frequency change), if applicable.

(4) The code rate, if applicable.

(5) The method of achieving synchronization.

(6) The center frequency and the frequency band over which the signal is spread.

(h) Notwithstanding the provisions of §97.105, the log entries required by paragraphs (c), (d), (e), (f), and (g) of this section shall be retained in the station log as long as the information contained in those entries is accurate.

In § 97.61, Authorized frequencies and emissions, add footnote number 1 to the 50-54 MHz, 144-148 MHz, and 220-225 MHz frequency bands as follows:

(a) The following frequency bands and associated emissions are available to amateur radio stations for amateur radio operation, other than repeater operation and auxiliary operation, subject to the limitations of §97.65 and paragraph (b) of this section:

Frequency band	Emissions	Limitations (See paragraph (b))
*	*	*
50.0-54.0[1]	A1	
50.1-54.0	A2, A3, A4, A5, F1, F2, F3, F5	
51.0-54.0	A0	
144-148[1]	A1	
144.1-148.0	A0, A2, A3, A4, A5, F0, F1, F2, F3, F5	
220-225[1]	A0, A1, A2, A3, A4, A5, F0, F1, F2, F3, F4, F5	
*	*	*

[1] Spread spectrum techniques for domestic communications only are authorized in this band.

In § 97.73, Purity of emissions, redesignate existing paragraph (d) as paragraph (e), revise existing paragraph (c) and redesignate it as paragraph (d), and add a new paragraph (c) to read as follows:

* * * * *

(c) The limitations specified in paragraph (b) of this section shall also apply to spread spectrum modulated signals except that for this purpose, "carrier frequency" is defined as the center frequency of the transmitted signal, and "mean power of the fundamental" is defined as the total emitted power.

(d) Paragraphs (a), (b), and (c) of this section notwithstanding, all spurious emissions or radiation from an amateur transmitter, transceiver, or external radio frequency power amplifier shall be reduced or eliminated in accordance with good engineering practice.

(e) If any spurious radiation, including chassis or power line radiation, causes harmful interference to the reception of another radio station, the licensee may be required to take steps to eliminate the interference in accordance with good engineering practice.

* * * * *

Revise § 97.117, Codes and ciphers prohibited, to read as follows:

(a) The transmission by radio of messages in codes or ciphers in domestic and international communications to or between amateur stations is prohibited. All communications regardless of type of emission employed shall be in plain language except that generally recognized abbreviations established by regulation or custom and usage are permissible as are any other abbreviations or signals where the intent is not to obscure the meaning but only to facilitate communications.

(b) Spread spectrum transmissions between amateur stations of different countries are prohibited. However, for the purpose of the spread spectrum transmissions authorized between domestic stations in §97.7 and §97.61, pseudorandom sequences may be used to generate the transmitted signal provided the following conditions are met:

(1) The sequence must be the output of a binary linear feedback shift register.

(2) Only the following shift register connections may be used:

Number of Stages in Shift Register	Taps Used in Feedback
7	[7,1]
13	[13,4,3,1]
19	[19,5,2,1]

(The numbers in brackets indicate which binary stages are combined with modulo-2 addition to form the input to the shift register in stage 1. The output is taken from the highest numbered stage.)

(3) For direct sequence modulation the successive bits of the highest stage of the shift register must be used directly to modulate the signal. No alteration or other data may be used for the direct sequence modulation. For frequency hop modulation, successive regular segments of the shift register sequence must be used to specify the next frequency, and no alteration or other data may be used for frequency selection.

(4) The shift register(s) may not be reset other than by its feedback during an individual transmission.

In § 97.131, Restricted operation, redesignate existing paragraph (b) as paragraph (c) and add a new paragraph (b) to read as follows:

* * * * *

(b) If the operation of an amateur station using spread spectrum techniques causes interference to other licensed stations, the Commission's local Engineer in Charge may impose conditions necessary to resolve the interference, including termination of operation, on the offending station.

(c) In general, such steps as may be necessary to minimize interference to stations operating in other services may be required after investigation by the Commission.

June 30, 1981

CONCURRING STATEMENT OF COMMISSIONER ABBOTT WASHBURN

re: Notice of Inquiry and Proposed Rule Making to Amend Parts 2 and 97 of the Commission's Rules and Regulations to Authorize Spread Spectrum Modulation in the Amateur Radio Service

The second paragraph of this item states: "we feel comfortable proposing the authorization of spread spectrum modulation". I do not share this feeling of comfort when the same document includes the following language: "A major concern of the Commission in allowing amateur use of spread spectrum techniques is the Commission's, and the amateur's own, ability to monitor and locate stations transmitting wideband emissions". So there is no real control. While new technology is to be encouraged, especially that which allows more use of the spectrum, this should not be at the price of interference. There must be assurance that expanded use of this technology will contribute to the effective and efficient use of the spectrum while at the same time not adding interference to the detriment of other technologies and spectrum users in general.

In a related Notice of Inquiry adopted today, the Commission initiated a proceeding seeking information regarding the future authorization of spread spectrum and other wideband emissions not presently provided for in our Rules. That inquiry requests information and data regarding the technical characteristics, efficient use of spectrum, possible standardization, potential applications of this technology, etc. It also raises questions regarding the measurement of interference potential, emission testing and the necessity for Commission monitoring. With issues such as these still in the initial and infant stage of information gathering, the Commission seems to be prejudging important issues by rushing to Rulemaking. A more prudent approach would be first to obtain the facts on monitoring and interference via the NOI, assess these facts, and <u>then</u> move to Rulemaking. However, we are assured by the staff that the risks involved will be minimal. I hope this proves to be the case.

CORRESPONDENCE

Dear Paul:

I'd love to make your Computer Networking conference but that's not practical. Are you planning to record any of the proceedings and/or develop any monographs which could be made available to those of us in far away places?

California OES is on the verge of providing damage assessment information from cities to counties to state via CPM equipped micros and we've demonstrated the passing of their info at 110 baud ASCII via VHF/UHF circuits. Also, the OES people are concerned about the larger volumes of mass shelter info to be passed when the lines are down, and we can help there too. But, getting radio/computer-equipped hams insterested in public service and willing to generate volumes of real-time traffic/information isn't going to be any easier on 1200 baud and above!

I'm trying to figure out whether we should forget the service we are just starting to provide and opt for packet radio systems, repeaters, etc? Should we get off the bus which plods its way to its destination and try a space shuttle which gets somewhere faster? These are rhetorical questions I face monthly while still trying to taste of some of the more advanced techniques!

With regard to the conference, maybe we can call on Hank Magnuski, KA6M, to come down and meet with us in the fall.especially since he will have participated in your sessions. Keep up the great work!

73,

Robert N. Dyruff, W6POU
SCM, Santa Barbara Section, ARRL
1188 Summit Rd
Santa Barbara, CA 93108

THE AMATEUR RADIO RESEARCH AND DEVELOPMENT CORPORATION is a technically oriented club of about 400 radio and computer amateurs. It is incorporated in the Commonwealth of Virginia and is recognized by the Internal Revenue Service as a tax-exempt scientific and educational organization.

THE PURPOSES OF THE CLUB are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize forums and technical symposiums; collect and disseminate technical information; and, provide experimental repeaters.

MEETINGS ARE ON 1st MONDAY of each month at 7:30 p.m. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the 1st Monday is a holiday, an alternate date will be announced in the *AMRAD Newsletter*. Except for the annual meeting in December, meetings are normally reserved for technical talks - not business.

THE WD4IWG/R REPEATER is an open repeater for data communications (including RTTY), voice and experimental modes. It is located at Tyson's Corner, McLean, VA and has excellent coverage. It features a semi-private autopatch available to licensed members. Frequencies are: 147.81 MHz input, 147.21 MHz output. The head of the technical committee is Jeff Brennan, WB4WLW, 7817 Bristow Dr, Annandale, VA 22003, phone 703-354-8541.

THE AMRAD NEWSLETTER is mailed monthly to all members and to other clubs on an exchange basis. Technical articles, new product announcements, news items, calls for papers and other copy related to amateur radio and computing are welcome. Honorariums at a rate of $10 per printed page ($20 maximum per author per issue) are paid for original material accepted. Classified ads are free to members. Commercial ad inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. Items should be mailed by the 8th of the preceeding month to Paul L. Rinaldo, W4RI, Editor, 1524 Springvale Ave, McLean, VA 22101; phone 703-356-8918. Full permission for reprinting or quoting items appearing in the *AMRAD Newsletter* is granted provided that credit is given. Mailing is by 3rd Class bulk mail to U.S. addresses and 1st Class to Canada and Mexico. Overseas readers add 96¢ for surface or $7.80 for air mail to annual dues.

THE AMRAD MESSAGE SYSTEM is an S-100 Computerized Bulletin Board System on 703-734-1387, system operator Terry Fox, WB4JFI. Terry's home phone number is 703-356-8334. The system accepts 110, 300, 450 and 600 baud ASCII callers using Bell 103-compatible modems.

THE HANDICAPPED EDUCATION EXCHANGE (HEX) is operated by AMRAD for those involved in education and communications for the handicapped. It accepts both 110/300-baud ASCII and deaf TTY callers. on 301-593-7033. The sysop Dick Barth, W3HWN's home phone is 301-681-7372.

AMRAD OFFICERS for 1981 are:

Gerald Adkins, N4GA	Treasurer
Jeffrey Brennan, WB4WLW	Director
	Repeater Trustee
Tedd Riggs, KC4YN	Librarian
Robert E. Bruninga, WB4APR	Director
	VP-Asia
Kenneth Coghill, WB4ZOH	1st Alt.
Terry Fox, WB4JFI	Director
	Vice Pres.
	Computer Trustee
William Pala, Jr., WB4NFB	Director
	Secretary
Paul L. Rinaldo, W4RI	Director
	President
Elton A. Sanders, Jr., WB5MMB	2nd Alt.

THE AMRAD LIBRARY is operated by Tedd Riggs, KC4YN, 8402 Berea Ct, Vienna, VA 22180, phone 703-573-5067. Donations of technical books, magazines, manuals and catalogs are tax-deductible.

AMRAD IS AFFILIATED with the American Radio Relay League (ARRL), the Foundation for Amateur Radio, the Northern Virginia Radio Council (NOVARC) and The Mid Atlantic Repeater Council (T-MARC).

SPECIAL INTEREST GROUPS are formed from time to time. Currently we have SIG's on Deaf Communications and Spread Spectrum Communications. If you are interested in joining or forming a SIG, please contact Bill Pala, WB4NFB, 5829 Parakeet Dr, Burke, VA 22015; phone 703-323-8345.

TRAINING CLASSES are run as needed. Please discuss your training requirements with any Director.

AMATEUR RADIO RESEARCH AND
DEVELOPMENT CORPORATION
1524 SPRINGVALE AVENUE
MCLEAN, VA USA 22101

Nonprofit Organization
U.S. Postage
PAID
McLean, Virginia 22101
Permit No. 1511

HANK S MAGNUSKI KA6M
311 STANFORD AV
MENLO PARK CA 94025